Listing of Claims:

1. (Original) A jitter measuring apparatus comprising:

an orthogonal signal generating unit which converts a signal to be measured into two orthogonal signals which are two signals whose phases are orthogonal to one another;

5   an instantaneous phase calculating unit which calculates an instantaneous phase based on the two orthogonal signals converted by the orthogonal signal generating unit within a range between a lower limit phase value set in advance and an upper limit phase value set in advance;

10   a differential value detecting unit which detects a differential value of the instantaneous phase calculated by the instantaneous phase calculating unit;

a differential value correcting unit which corrects the differential value of the instantaneous phase, and which outputs

15   a corrected differential value when the differential value of the instantaneous phase detected by the differential value detecting unit is over the range dependent on the lower limit phase value and the upper limit phase value;

an offset component eliminating unit which eliminates an

20   offset component included in the corrected differential value from the corrected differential value output by the differential value correcting unit, and which outputs a differential value

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from which the offset component has been eliminated; and

an integration unit which determines a jitter amount of the
signal to be measured by integrating the differential value which
is output by the offset component eliminating unit, and from
which the offset component has been eliminated.

2. (Original) The jitter measuring apparatus according to
claim 1, wherein

a lower limit and an upper limit of the range dependent on
the lower limit phase value and the upper limit phase value are
respectively equal to or approximately equal to the lower limit
phase value and the upper limit phase value.

3. (Original) The jitter measuring apparatus according to
claim 1 or 2, wherein

the differential value correcting unit has

a discontinuous point detecting unit which detects the
differential value of the instantaneous phase as a discontinuous
point of the differential value of the instantaneous phase when
the differential value of the instantaneous phase detected by the
differential value detecting unit is over the range dependent on
the lower limit phase value and the upper limit phase value, and

a continuity insuring unit which insures continuity of the
differential value of the instantaneous phase by correcting a

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discontinuous point of the differential value of the

instantaneous phase detected by the discontinuous point detecting

unit with respect to the differential value of the instantaneous

15   phase detected by the differential value detecting unit, and

outputting the corrected differential value.

4. (Original) The jitter measuring apparatus according to

claim 1 or 2, wherein

the differential value correcting unit has

a discontinuous point detecting unit which detects the

5   differential value of the instantaneous phase as a discontinuous

point of the differential value of the instantaneous phase when

the differential value of the instantaneous phase detected by the

differential value detecting unit is over the range dependent on

the lower limit phase value and the upper limit phase value, and

10   a discontinuous point eliminating unit which eliminates the

discontinuous point of the differential value of the

instantaneous phase detected by the discontinuous point detecting

unit with respect to the differential value of the instantaneous

phase detected by the differential value detecting unit and

15   outputs the eliminated differential value.

5. (Original) The jitter measuring apparatus according to

claim 1 or 2, wherein

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the differential value correcting unit has

a discontinuous point detecting unit which detects the

5   differential value of the instantaneous phase as a discontinuous

point of the differential value of the instantaneous phase when

the differential value of the instantaneous phase detected by the

differential value detecting unit is over the range dependent on

the lower limit phase value and the upper limit phase value, and

10   a discontinuous point interpolating unit which substantially

insures continuity of the differential value of the instantaneous

phase by eliminating the discontinuous point of the differential

value of the instantaneous phase detected by the discontinuous

point detecting unit with respect to the differential value of

15   the instantaneous phase detected by the differential value

detecting unit and interpolating the eliminated portion and

outputting the interpolated differential value.

6. (Original) The jitter measuring apparatus according to

claim 1, wherein

the offset component eliminating unit has

a memory in which a value determined by an operation of

5    $2\pi(fc/fs)$ showing the offset component is stored in advance when

a frequency fc of the signal to be measured and a sampling

frequency fs for sampling the signal to be measured have been already known, and

a subtraction unit which subtracts the value showing the offset component stored in the memory from the corrected differential value output by the differential value correcting unit.

7. (Original) The jitter measuring apparatus according to claim 1, wherein

the offset component eliminating unit has

a mean value calculating unit which determines a mean value of the corrected differential value output by the differential value correcting unit as an offset component in advance when a frequency fc of the signal to be measured and a sampling frequency fs for sampling the signal to be measured have been unknown, and

a subtraction unit which subtracts the mean value of the corrected differential value serving as the offset component determined by the mean value calculating unit from the corrected differential value output by the differential value correcting unit.

8. (Original) The jitter measuring apparatus according to claim 1, wherein,

when a lower limit frequency fj of a jitter component which

is an object to be detected is designated, the offset component

5   eliminating unit includes a high-pass filter which has a

frequency equal to or approximately equal to the lower limit

frequency fj of the jitter component which is the object to be

detected as a cutoff frequency for eliminating the offset

component from the corrected differential value output by the

10   differential value correcting unit.

9. (Original) The jitter measuring apparatus according to

claim 1, wherein,

given that a digital signal sequence of the signal to be

measured is x(n), a frequency and an amplitude of the signal to

5   be measured are respectively fc and Ac, a sampling frequency for

sampling the signal to be measured is fs, and an initial phase

and a jitter of the signal to be measured are respectively θc and

$\phi(n)$, n=0,1,2, ..., and when I(n), Q(n) serving as the two

orthogonal signals are respectively expressed by

10    $I(n)=x(n)=Ac\cdot\cos [2\pi(fc/fs)n+\theta c+\phi(n)]$,

$Q(n)=Ac\cdot\sin [2\pi(fc/fs)n+\theta c+\phi(n)]$,

and $\Theta(n)$ serving as the instantaneous phase is expressed by

$\Theta(n)=\tan^{-1} [Q(n)/I(n)]$

$=2\pi(fc/fs)n+\theta c+\phi(n)$,

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15   the instantaneous phase calculating unit calculates $\Theta(n)$ serving

as the instantaneous phase determined by an operation of the

$\tan^{-1} [Q(n)/I(n)]$ within a range from $-\pi$ to π, or $-\pi/2$ to $\pi/2$ as

a range between the lower limit phase value set in advance and

the upper limit phase value set in advance.

     10. (Original) The jitter measuring apparatus according to

claim 9, wherein

    the differential value detecting unit calculates $\Delta\Theta(n)$

serving as the differential value of the instantaneous phase

5   calculated by the instantaneous phase calculating unit, by an

operation of

     $\Delta\Theta(n) = \Theta(n) - \Theta(n-1)$

       $= 2\pi(fc/fs) + \phi(n) - \phi(n-1)$ (Where, $\Theta(n-1)=0$, and here,

$2\pi(fc/fs)$ is a constant and an offset component).

     11. (Original) The jitter measuring apparatus according to

claim 10, wherein

    the differential value correcting unit carries out

arithmetic processing of

5    $\Delta\theta(n) = \Delta\Theta(n)$ $(-\pi \le \Delta\Theta(n) \le \pi)$,

     $\Delta\theta(n) = \Delta\Theta(n) + 2\pi$ $(-\pi > \Delta\Theta(n))$,

     $\Delta\theta(n) = \Delta\Theta(n) - 2\pi$ $(\Delta\Theta(n) > \pi)$

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or

$\Delta\theta(n) = \Delta\Theta(n)$ $(-\pi/2 \leq \Delta\Theta(n) \leq \pi/2)$,

$\Delta\theta(n) = \Delta\Theta(n) + \pi$ $(-\pi/2 > \Delta\Theta(n))$,

$\Delta\theta(n) = \Delta\Theta(n) - \pi$ $(\Delta\Theta(n) > \pi/2)$

with respect to $\Delta\Theta(n)$ serving as the differential value of the instantaneous phase in order to calculate $\Delta\theta(n)$ serving as the corrected differential value corrected so as to insure continuity by correcting the discontinuous point of $\Delta\Theta(n)$ serving as the differential value of the instantaneous phase calculated by the instantaneous phase calculating unit.

12. (Original) The jitter measuring apparatus according to claim 11, wherein the offset component eliminating unit eliminates the offset component $2\pi(fc/fs)$ from $\Delta\theta(n)$ serving as the corrected differential value corrected so as to insure the continuity by the differential value correcting unit, and outputs

$\Delta\phi(n) = \phi(n) - \phi(n-1)$

as $\Delta\phi(n)$ serving as the differential value from which the offset component has been eliminated to the integration unit.

13. (Original) The jitter measuring apparatus according to claim 12, wherein

the integration unit

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carries out a following integration

U(n)=ΣΔφ(i) (Where, the symbol Σ denotes the sum total of

i=0,1,2, ..., n, and here, provided that U(n) is theoretically

expanded, it is made to be

U(n)=[φ(0)-φ(-1)]+[φ(1)-φ(0)]+

[φ(2)-φ(1)]+.........+[φ(n)-φ(n-1)]

=φ(n)-φ(n-1) with respect to Δφ(n) serving as

the differential value which is output by the offset component

eliminating unit, and from which the offset component has been

eliminated, and

here, given that φ(-1)=0, an integrated result U(n) is to express

a jitter component φ(n) of the signal to be measured, and

outputs the integrated result U(n) as the jitter component

φ(n) of the signal to be measured.

14. (Currently Amended) A jitter measuring method

comprising:

a step of converting a signal to be measured into two

orthogonal signals which are two signals whose phases are

orthogonal to one another;

a step of calculating an instantaneous phase based on the

two orthogonal signals converted by the step of converting into

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the two orthogonal signals within a range between a lower limit
phase value set in advance and an upper limit phase value set in
advance;

a step of detecting a differential value of the
instantaneous phase calculated by the step of calculating the
instantaneous phase;

a step of correcting the differential value of the
instantaneous phase, and outputting a corrected differential
value when the differential value of the instantaneous phase
detected by the step of detecting the differential value of the
instantaneous phase is over the range dependent on the lower
limit phase value and the upper limit phase value;

a step of eliminating an offset component included in the
corrected differential value from the corrected differential
value output by the step of correcting the differential value of
the instantaneous phase, and outputting a differential value from
which the offset component has been eliminated; ~~and~~

a step of determining a jitter amount of the signal to be
measured by integrating the differential value which is output by
the step of eliminating the offset component, and from which the
offset component has been eliminated; and

a step of outputting the determined jitter amount to an
indicator.

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15. (Original) The jitter measuring method according to
claim 14, wherein

a lower limit and an upper limit of the range dependent on
the lower limit phase value and the upper limit phase value are
respectively equal to or approximately equal to the lower limit
phase value and the upper limit phase value.

16. (Original) The jitter measuring method according to
claim 14 or 15, wherein

the step of correcting the differential value of
the instantaneous phase has

a step of detecting the differential value of the
instantaneous phase as a discontinuous point of the differential
value of the instantaneous phase when the differential value of
the instantaneous phase detected by the step of detecting the
differential value of the instantaneous phase is over the range
dependent on the lower limit phase value and the upper limit
phase value, and

a step of insuring continuity of the differential value of
the instantaneous phase by correcting the discontinuous point of
the differential value of the instantaneous phase detected by the
step of detecting the discontinuous point of the differential
value of the instantaneous phase with respect to the differential
value of the instantaneous phase detected by the step of

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detecting the differential value of the instantaneous phase, and

outputting the corrected differential value.

17. (Original) The jitter measuring method according to

claim 14 or 15, wherein

the step of correcting the differential value of the

instantaneous phase has

5   a step of detecting the differential value of the

instantaneous phase as a discontinuous point of the differential

value of the instantaneous phase when the differential value of

the instantaneous phase detected by the step of detecting the

differential value of the instantaneous phase is over the range

10   dependent on the lower limit phase value and the upper limit

phase value, and

a step of eliminating the discontinuous point of the

differential value of the instantaneous phase detected by the

step of detecting the discontinuous point of the differential

15   value of the instantaneous phase with respect to the differential

value of the instantaneous phase detected by the step of

detecting the differential value of the instantaneous phase, and

outputting the eliminated differential value.

18. (Original) The jitter measuring method according to

claim 14 or 15, wherein

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the step of correcting the differential value of the
instantaneous phase has

5   a step of detecting the differential value of the
instantaneous phase as a discontinuous point of the differential
value of the instantaneous phase when the differential value of
the instantaneous phase detected by the step of detecting the
differential value of the instantaneous phase is over the range

10   dependent on the lower limit phase value and the upper limit
phase value, and

a step of substantially insuring continuity of
the differential value of the instantaneous phase by eliminating
the discontinuous point of the differential value of the

15   instantaneous phase detected by the step of detecting the
discontinuous point of the differential value of the
instantaneous phase with respect to the differential value of the
instantaneous phase detected by the step of detecting the
differential value of the instantaneous phase, and interpolating

20   the eliminated portion, and outputting the interpolated
differential value.

19. (Original) The jitter measuring method according to
claim 14, wherein
the step of eliminating the offset component has
a step of storing a value determined by an operation of

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5    $2\pi(fc/fs)$ showing the offset component in a memory in advance

when a frequency fc of the signal to be measured and a sampling

frequency fs for sampling the signal to be measured have been

already known, and

     a step of subtracting the value showing the offset component

10   stored in the memory from the corrected differential value output

by the step of correcting the differential value of the

instantaneous phase.

     20. (Original) The jitter measuring method according to

claim 14, wherein

     the step of eliminating the offset component has

     a step of determining a mean value of the corrected

5   differential value output by the step of correcting the

differential value of the instantaneous phase as an offset

component in advance when a frequency fc of the signal to be

measured and a sampling frequency fs for sampling the signal to

be measured have been unknown, and

10   a step of subtracting the mean value of the corrected

differential value serving as the offset component determined by

the step of determining the mean value of the corrected

differential value, from the corrected differential value output

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by the step of correcting the differential of the instantaneous

15   phase.

      21. (Original) The jitter measuring method according to

claim 14, wherein,

      when a lower limit frequency fj of a jitter component which

is an object to be detected is designated, the step of

5   eliminating the offset component uses a high-pass filter which

has a frequency equal to or approximately equal to the lower

limit frequency fj of the jitter component which is the object to

be detected as a cutoff frequency for eliminating the offset

component from the corrected differential value output by the

10   step of correcting the differential value of the instantaneous

phase.

      22. (Original) The jitter measuring method according to

claim 14, wherein,

      given that a digital signal sequence of the signal to be

measured is x(n), a frequency and an amplitude of the signal to

5   be measured are respectively fc and Ac, a sampling frequency for

sampling the signal to be measured is fs, and an initial phase

and a jitter of the signal to be measured are respectively θc and

ϕ (n), n=0,1,2, ..., and when I(n), Q(n) serving as the two

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orthogonal signals are respectively expressed by

10   I(n)=x(n)=Ac·cos [2π(fc/fs)n+θc+φ(n)],

        Q(n)=Ac·sin [2π(fc/fs)n+θc+φ(n)],

and Θ(n) serving as the instantaneous phase is expressed by

        Θ(n)=tan^{-1} [Q(n)/I(n)]

            =2π(fc/fs)n+θc+φ(n),

15   the step of calculating the instantaneous phase calculates Θ(n)

    serving as the instantaneous phase determined by an operation of

    the tan^{-1} [Q(n)/I(n)] within a range from −π to π, or −π/2 to π/2

    as a range between the lower limit phase value set in advance and

    the upper limit phase value set in advance.

        23. (Original) The jitter measuring method according to

    claim 22, wherein

        the step of detecting the differential value of

    the instantaneous phase calculates ΔΘ(n) serving as

5   the differential value of the instantaneous phase calculated by

    the step of calculating the instantaneous phase, by an operation

    of

        ΔΘ(n)=Θ(n)−Θ(n-1)

            =2π(fc/fs)+ φ(n)−φ(n-1) (Where, Θ(n-1)=0, and here,

10   2π(fc/fs) is a constant and an offset component).

24. (Original) The jitter measuring method according to claim 23, wherein

the step of correcting the differential value of the instantaneous phase carries out arithmetic processing of

$$\Delta\theta(n) = \Delta\Theta(n) \qquad (-\pi \leq \Delta\Theta(n) \leq \pi),$$

$$\Delta\theta(n) = \Delta\Theta(n) + 2\pi \qquad (-\pi > \Delta\Theta(n)),$$

$$\Delta\theta(n) = \Delta\Theta(n) - 2\pi \qquad (\Delta\Theta(n) > \pi)$$

or

$$\Delta\theta(n) = \Delta\Theta(n) \qquad (-\pi/2 \leq \Delta\Theta(n) \leq \pi/2),$$

$$\Delta\theta(n) = \Delta\Theta(n) + \pi \qquad (-\pi/2 > \Delta\Theta(n)),$$

$$\Delta\theta(n) = \Delta\Theta(n) - \pi \qquad (\Delta\Theta(n) > \pi/2)$$

with respect to $\Delta\Theta(n)$ serving as the differential value of the instantaneous phase in order to calculate $\Delta\theta(n)$ serving as the corrected differential value corrected so as to insure continuity by correcting a discontinuous point of $\Delta\Theta(n)$ serving as the differential value of the instantaneous phase calculated by the step of calculating the instantaneous phase.

25. (Original) The jitter measuring method according to claim 24, wherein the step of eliminating the offset component eliminates the offset component $2\pi(fc/fs)$ from $\Delta\theta(n)$ serving as the corrected differential value corrected so as to insure the continuity by the step of correcting the differential value, and

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outputs

$\Delta\phi(n)=\phi(n)-\phi(n-1)$

as $\Delta\phi(n)$ serving as the differential value from which the offset
component has been eliminated.

26. (Original) The jitter measuring method according to
claim 25, wherein

the step of integrating the differential value from which
the offset component has been eliminated

5   carries out a following integration

$U(n)=\Sigma\Delta\phi(i)$ (Where, the symbol Σ denotes the sum total of
$i=0,1,2, \ldots, n$, and here, provided that $U(n)$ is theoretically
expanded, it is made to be

$U(n)=[\phi(0)-\phi(-1)]+[\phi(1)-\phi(0)]+$

10      $[\phi(2)-\phi(1)]+\ldots\ldots+[\phi(n)-\phi(n-1)]$

$=\phi(n)-\phi(n-1)$

with respect to $\Delta\phi(n)$ serving as the differential value
which is output by the step of eliminating the offset component,
and from which the offset component has been eliminated,

15   and here, given that $\phi(-1)=0$, an integrated result $U(n)$ is to
express a jitter component $\phi(n)$ of the signal to be measured, and

outputs the integrated result $U(n)$ as the jitter component
$\phi(n)$ of the signal to be measured.

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